That which is claimed is:

1. A non-invasive *in vivo* method for assessing carotenoids in the retina and/or macula, comprising:

performing Optical Coherence Tomography (OCT) on a retina of a subject; and

generating a spatial representation of carotenoid levels in the retina based on data from the OCT of the retina.

2. A method according to Claim 1, wherein the performing step comprises transmitting a blue excitation light to the retina.

3. A method according to Claim 1, wherein the performing step comprises transmitting an excitation light comprising a blue excitation light and an infrared excitation light.

4. A method according to Claim 1, wherein the generating step comprises applying a wavelet transformation to an OCT signal to generate spectral data of the retina.

5. A method according to Claim 1, wherein the performing step comprises transmitting a low coherence light with a superluminescent diode.

6. A method according to Claim 1, wherein the performing step comprises obtaining an absorption and/or reflectance spectrum of the retina and identifying levels of carotenoids therein in response to the absorption and/or reflectance spectrum.

7. A method according to Claim 1, wherein the generating step comprises repeating the performing and generating steps after administration of a selected treatment to provide a first and second spatial representation of carotenoid levels in the retina.

8. A method according to Claim 7, further comprising comparing the first spatial representation with the second spatial representation and evaluating the efficacy of the selected treatment on age related macular degeneration (AMD) based on the comparing step.

9. A method according to Claim 1, wherein the carotenoids include at least one of β-carotene, lutein, lycopene, xanthophyl, xanthophyll, and/or zeaxanthin.

10. A method according to Claim 1, wherein carotenoids of interest have a chemical structure having at least one alternating double carbon-carbon bonds and/or single carbon-carbon bonds.

11. A method according to Claim 1, wherein the generating step includes comparing a detected light spectrum from the OCT to *a priori* reference spectra corresponding a plurality of different known concentrations of the carotenoids.

12. A method according to Claim 1, wherein the generating step is able to determine a retinoid concentration level in the retina.

13. A method according to Claim 1, further comprising detecting a resonant Raman spectra based on the OCT data.

14. A method according to Claim 1, wherein the performing step comprises:

scanning the retina with low coherence light of an OCT scanner;

detecting reemitted light from the retina in response thereto;

interfering the detected light from the retina with a reference light beam to provide an interference signal; and

obtaining a light spectrum from the interference signal.

15. A method according to Claim 1, wherein the performing step comprises detecting reflectance and/or absorption spectra of different layers of the retina.

16. A method according to Claim 15, wherein the different layers includes at least seven layers.

17. A method according to Claim 1, wherein the generating step comprises generating a two-dimensional map of carotenoid levels in a cross-sectional spatial representation of the retina from the OCT.

18. A method according to Claim 1, wherein the generating step comprises generating a three-dimensional morphology map of carotenoid levels in the retina.

19. A method according to Claim 1, wherein the spatial representation comprises a map of a plurality of adjacent layers of the retina and covers a region about 2-5 mm wide.

20. A method according to Claim 1, wherein the spatial representation comprises at least about 1000 data pixels.

21. A method according to Claim 1, wherein the generating step comprises generating an intensity graduated and/or color indexed image of different levels of carotenoids in the retina.

22. A method according to Claim 1, further comprising assessing age-related macular degeneration (AMD) based on the spatial representation of the carotenoid levels.

23. A method according to Claim 1, further comprising:

illuminating a portion of the retina with an optical excitation beam having a wavelength selected to generate a resonant Raman spectrum of at least one of the carotenoids;

detecting a resonant Raman spectrum corresponding to the selected illuminated region of the eye; and

combining resonant Raman spectrum data with OCT data to generate the spatial representation of carotenoid levels in the retina.

24. A method according to Claim 23, wherein the generating and illuminating steps are performed substantially simultaneously.

25. A method according to Claim 24, wherein the generating step further comprises detecting an OCT signal, the method further comprising filtering the resonant Raman spectrum from the OCT signal.

26. A method according to Claim 1, wherein the performing step comprising performing OCT on the macular portion of the retina.

27. A system for providing non-invasive *in vivo* assessment of macular and/or retinal carotenoids comprising:

an Optical Coherence Tomography (OCT) scanner configured to generate an OCT scan of the retina; and

a carotenoid mapping module in communication with the OCT scanner, the carotenoid mapping module configured for generating a spatial representation of carotenoid levels in the retina based on data obtained from the OCT scanner.

28. A system according to Claim 27, wherein the OCT scanner comprises a blue excitation light source.

29. A system according to Claim 27, wherein the OCT scanner comprises a blue excitation light source and an infrared light source.

30. A system according to Claim 27, wherein the carotenoid mapping module is configured to apply a wavelet transformation to an OCT signal from the OCT scanner to generate spectral data of the retina.

31. A system according to Claim 27, wherein the OCT scanner comprises a superluminescent diode.

32. A system according to Claim 27, wherein the OCT scanner is configured to obtain an absorption and/or reflectance spectrum of the retina, and the carotenoid mapping module is configured to identify levels of carotenoids in response to the absorption and/or reflectance spectrum.

33. A system according to Claim 27, wherein the carotenoid mapping module comprises an *a priori* reference spectra corresponding to different concentrations of a plurality of different concentrations of carotenoids, and wherein the system is configured to compare OCT data with the reference spectra.

34. A system according to Claim 26, wherein the carotenoid mapping module is configured to determine a retinoid concentration in the retina.

35. A system according to Claim 27, wherein the carotenoid mapping module is configured to detect a resonant Raman spectra based on the OCT data.

36. A system according to Claim 27, wherein the OCT scanner comprises a low coherence light source, a detector for detecting reemitted light from the retina in response to the low coherence light source, and an interferometer for interfering the detected light from the retina with a reference light beam.

37. A system according to Claim 27, wherein the OCT scanner is configured to provide OCT scans from different layers of the retina, and the

carotenoid mapping module is configured to generate a cross-sectional spatial representation of the carotenoid levels in the retina for the different layers.

38. A system according to Claim 37, wherein the different layers includes at least seven layers.

39. A system according to Claim 27, wherein the carotenoid mapping module is configured to generate a two-dimensional map of carotenoid levels in a cross-sectional spatial representation of the retina from absorption and/or reflectance spectra from the OCT scanner.

40. A system according to Claim 27, wherein the carotenoid mapping module is configured to generate a three-dimensional morphology map of carotenoid levels in the retina.

41. A system according to Claim 40, wherein the carotenoid mapping module is configured to generate the three-dimensional morphology map using amplitude and spectral data of absorption and/or reflectance spectra from the OCT scanner.

42. A system according to Claim 27, wherein the spatial representation comprises a map of a plurality of adjacent layers of the retina and covers a region that is about 2-5 mm wide.

43. A system according to Claim 27, wherein the carotenoid mapping module is configured to provide a spatial representation comprising at least about 1000 data pixels.

44. A system according to Claim 27, wherein the carotenoid mapping module is configured to provide a spatial representation having an intensity graduated and/or color indexed images of different levels of carotenoids in the retina.

45. A system according to Claim 27, further comprising:

a Raman excitation source having a wavelength selected to generate a resonant Raman spectrum of at least one of the carotenoids; and

a Raman spectrometer configured to receive the resonant Raman spectrum;

wherein the carotenoid mapping module is configured to combine resonant Raman data and OCT data from the OCT scanner to generate the spatial representation of carotenoid levels.

46. A system according to Claim 45, wherein the Raman spectrometer and the OCT scanner are configured to obtain OCT and Raman spectra substantially simultaneously.

47. A system according to Claim 46, wherein the carotenoid mapping module further comprises a filter for filtering the resonant Raman spectrum from an OCT signal.

48. A system according to Claim 27, wherein the OCT scanner is configured to generate an OCT scan of the macula.

49. An *in vivo* method for assessing carotenoids in a tissue of interest, comprising:

performing Optical Coherence Tomography (OCT) on selected tissue of interest in and/or on a subject; and

generating a spatial representation of carotenoid levels in the selected tissue based on data from the OCT of the region.

50. A non-invasive *in vivo* method for assessing retinoids in the macula and/or retina, comprising:

performing Optical Coherence Tomography (OCT) on a retina of a subject; and

generating a spatial representation of retinoid levels in the retina based on data from the OCT of the retina.